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Yang et al.

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(54) **AUTOMATIC CURSOR ROTATION**

(71) Applicant: **Acer Incorporated**, New Taipei (TW)

(72) Inventors: **Tsung-Hang Yang**, New Taipei (TW); **Yu-Hsuan Shen**, New Taipei (TW); **Yi-Wen Liu**, New Taipei (TW)

(73) Assignee: **ACER INCORPORATED**, New Taipei (TW)

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
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G06F 3/0488 (2013.01)

(52) **U.S. Cl.**
CPC ***G06F 3/04812*** (2013.01); ***G06F 3/0488*** (2013.01); ***G06F 3/04886*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

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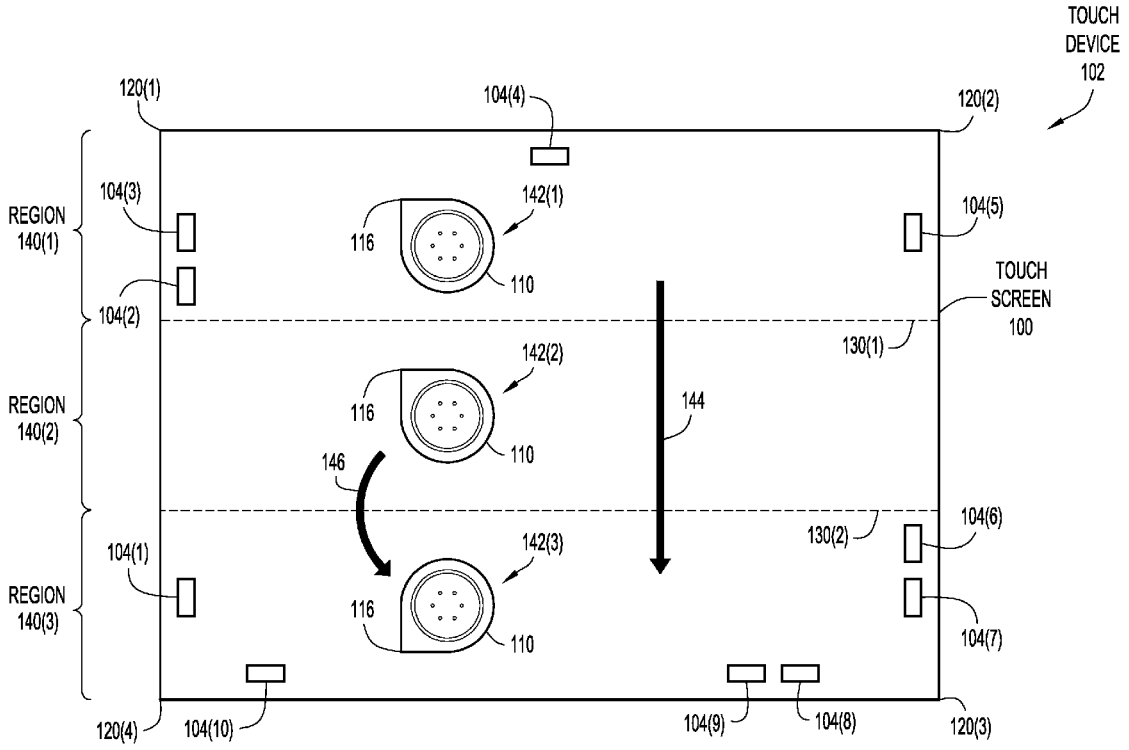
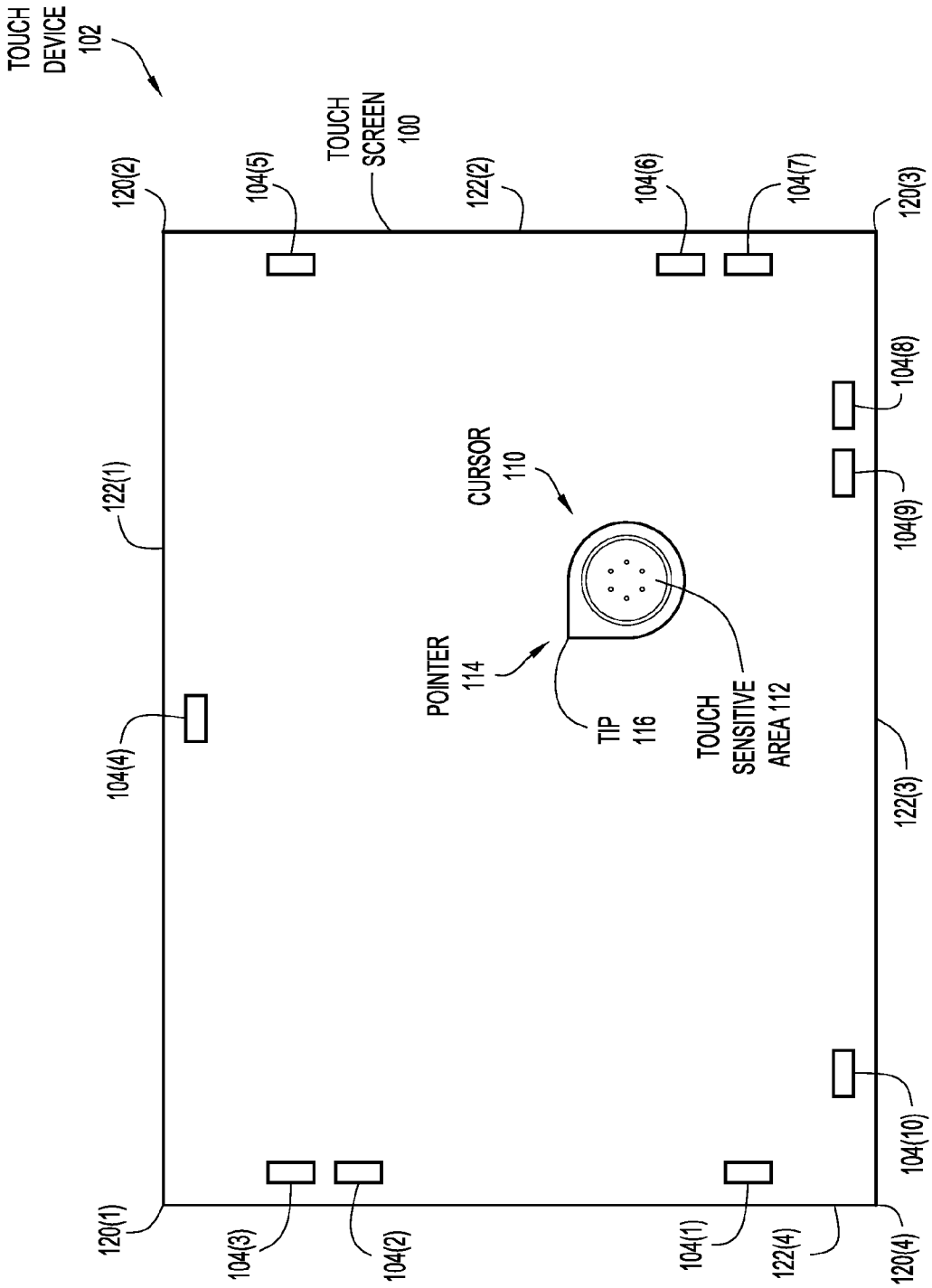
Primary Examiner — David D Davis
(74) *Attorney, Agent, or Firm* — Edell, Shapiro & Finnan, LLC

(57) **ABSTRACT**

A method for displaying of a touch cursor is provided. The method is adapted to an electronic apparatus having a touch display unit. The touch display unit has a display area. The method includes the following steps. At least one first dimension boundary and at least one second dimension boundary are defined in the display area. A cursor, which has a pointing area and a touchable area, is displayed. When a touch event occurs in the touchable area, the cursor is correspondingly moved according to a touch coordinate of the touch event. When a reference point of the cursor passes two of the at least one first dimension boundary or two of the at least one second dimension boundary, the cursor is rotated for adjusting a relative position of the pointing area and the touchable area.

20 Claims, 10 Drawing Sheets

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104(9)
122(1)
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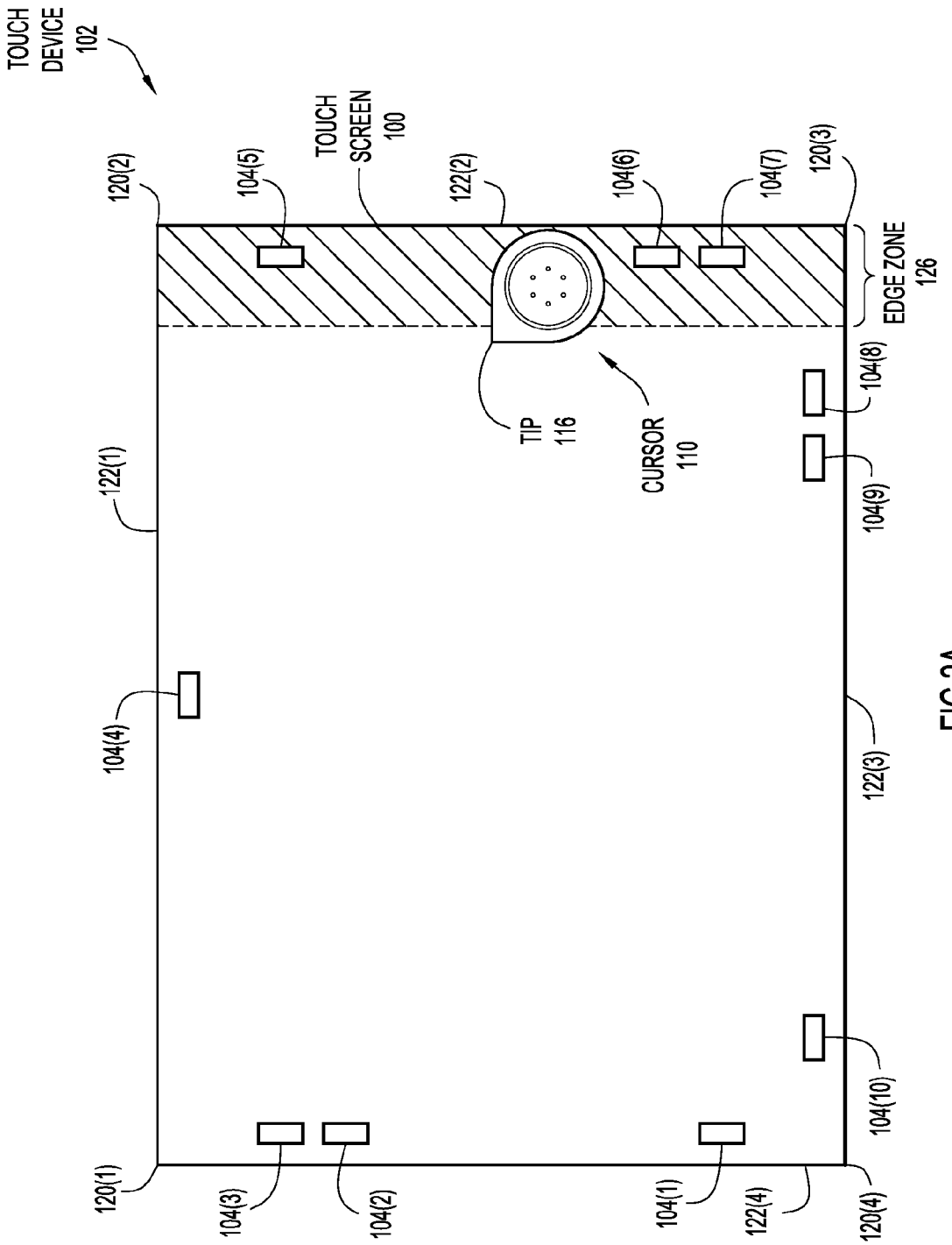
POINTER 114
TIP 116
TOUCH SENSITIVE AREA 112
104(4)
122(3)
104(10)
120(1)
104(3)
104(2)
104(1)
122(4)
120(4)

FIG.1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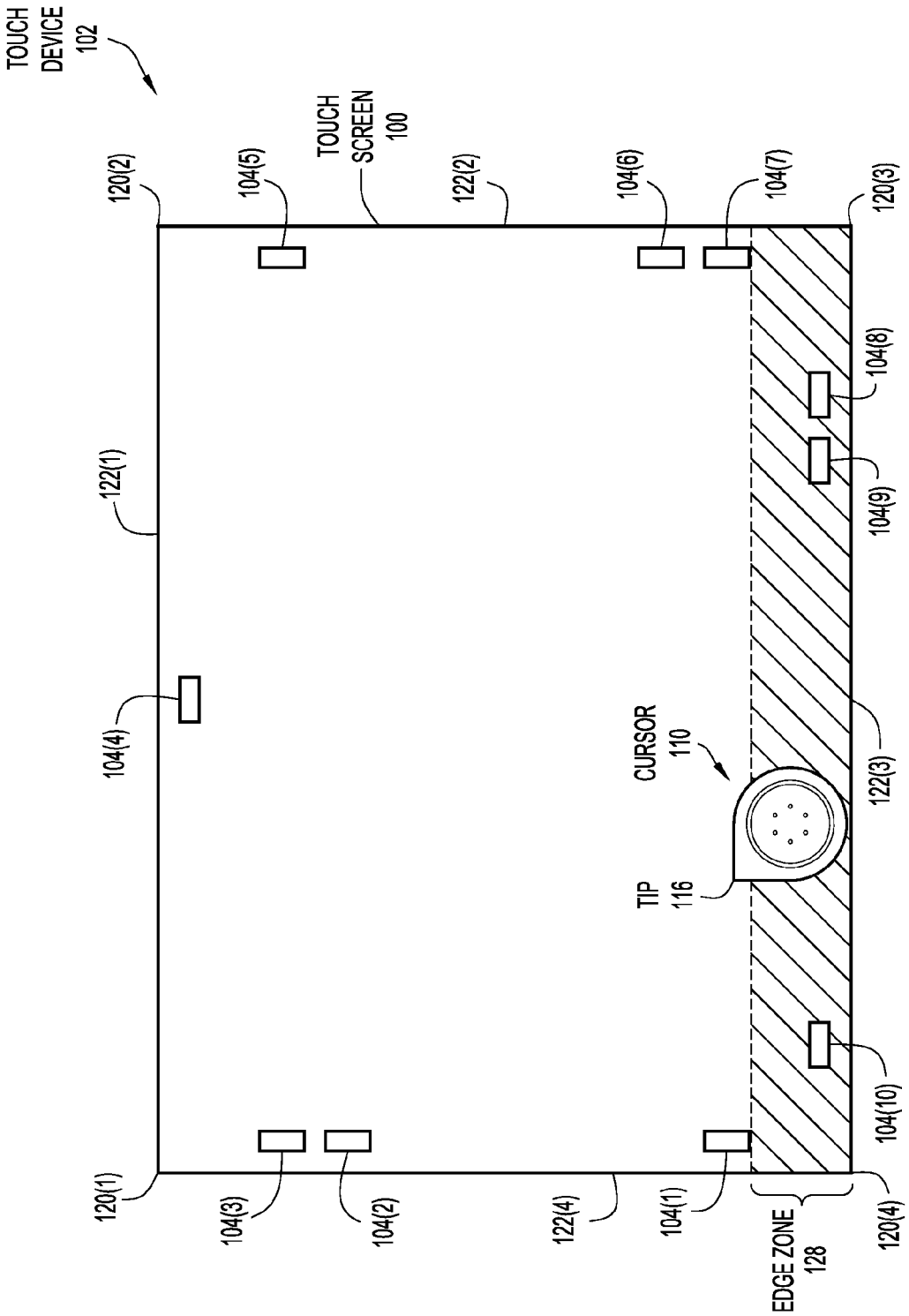
104(8)
104(9)
122(1)
104(4)
122(3)
104(10)
120(1)
104(3)
104(2)
104(1)
122(4)
120(4)

FIG.2A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122(1)
104(4)
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122(3)
TIP 116
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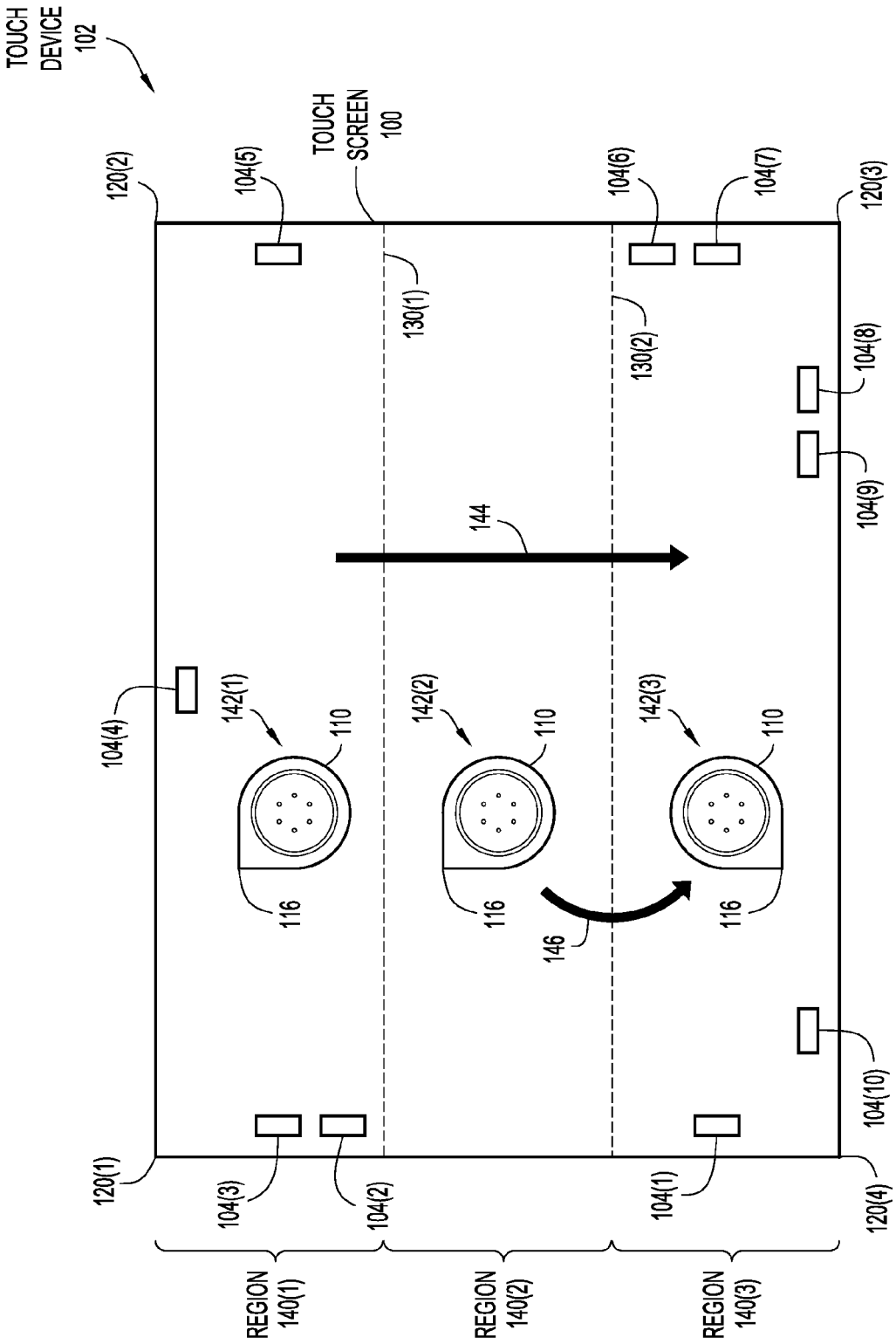
120(1)
104(3)
104(2)
122(4)
104(1)
EDGE ZONE 128
120(4)

FIG.2B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104(4)
142(1)
142(2)
142(3)
110
116
146
104(10)
120(1)
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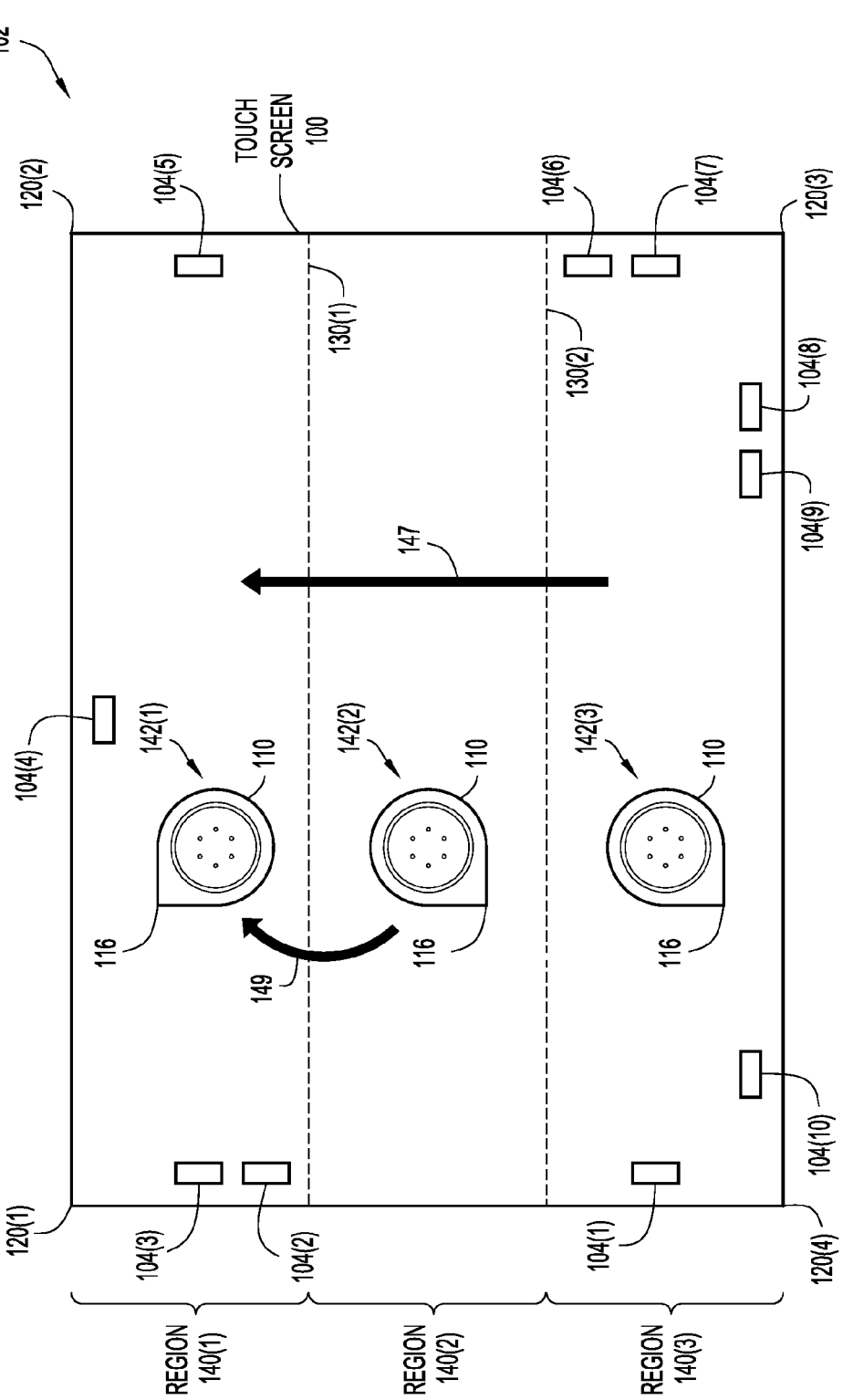
REGION 140(1)
REGION 140(2)
REGION 140(3)

FIG.3A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110
142(2)
110
142(3)
110
116
116
116
149
104(10)
120(1)
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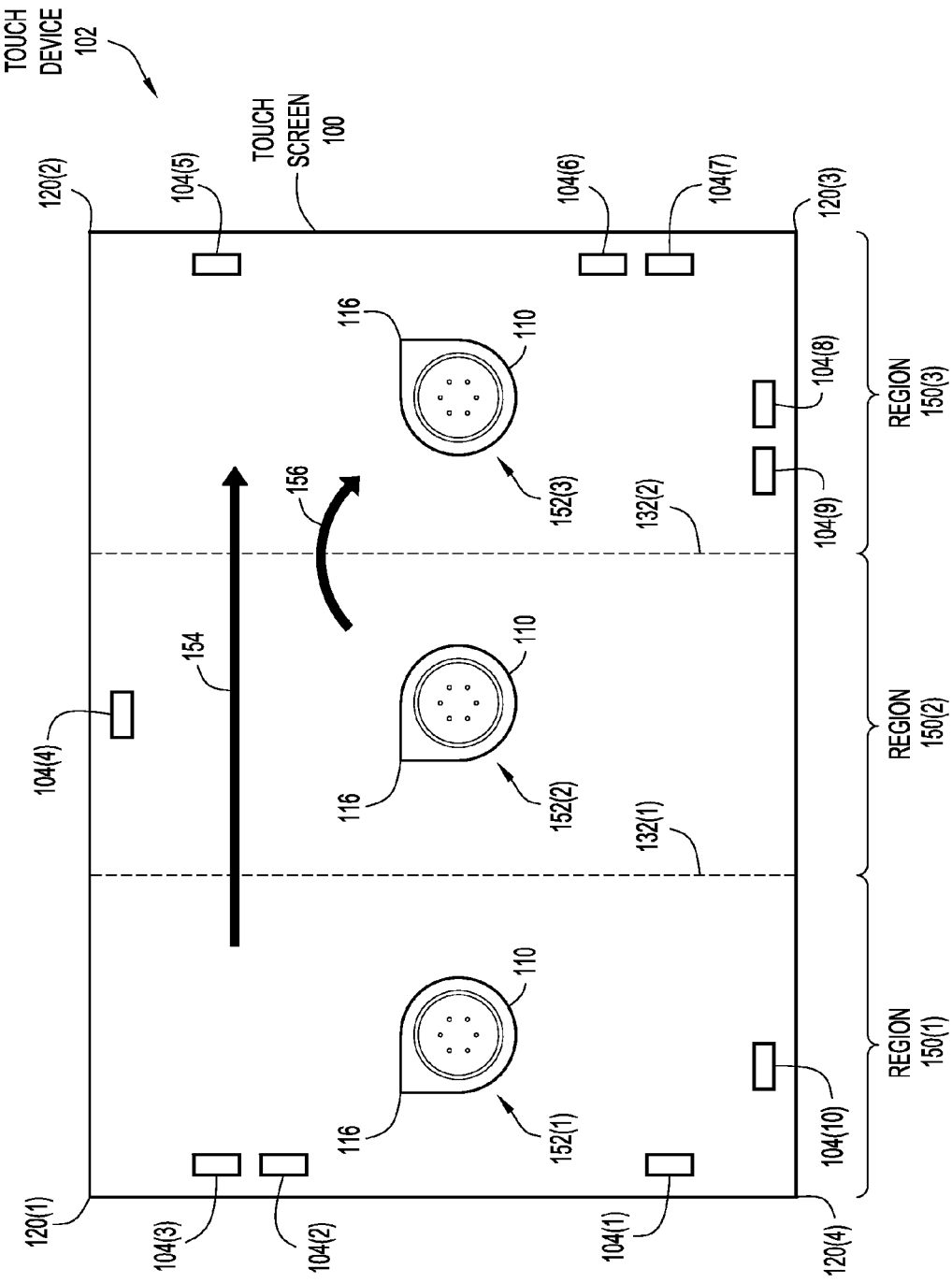
REGION 140(1)
REGION 140(2)
REGION 140(3)

FIG.3B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120(3)
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152(3)
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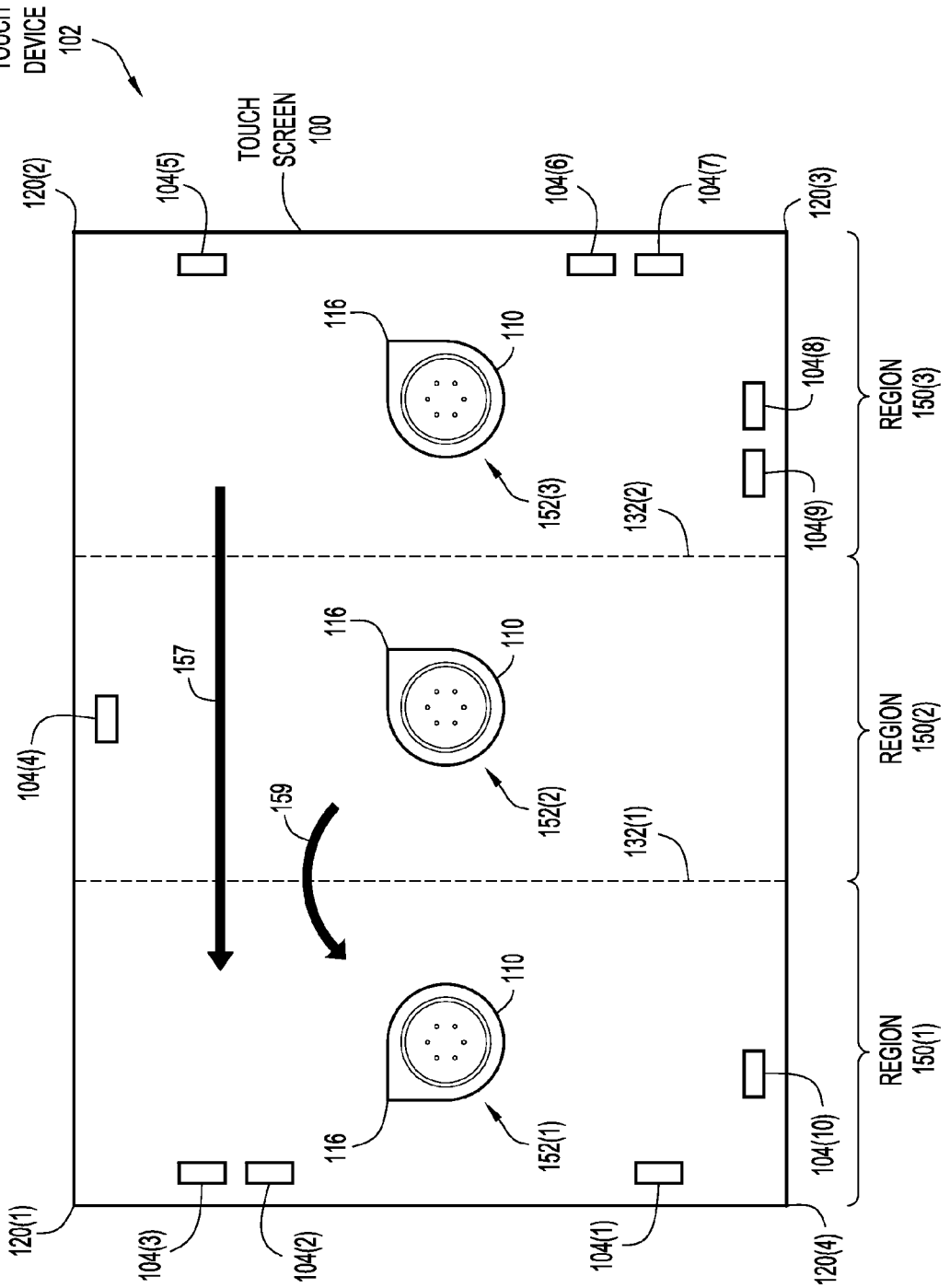
132(2)
104(8)
104(9)
REGION 150(3)
154
104(4)
116
110
152(2)
132(1)
REGION 150(2)
116
110
152(1)
104(10)
REGION 150(1)
120(1)
104(3)
104(2)
104(1)
120(4)

FIG.4A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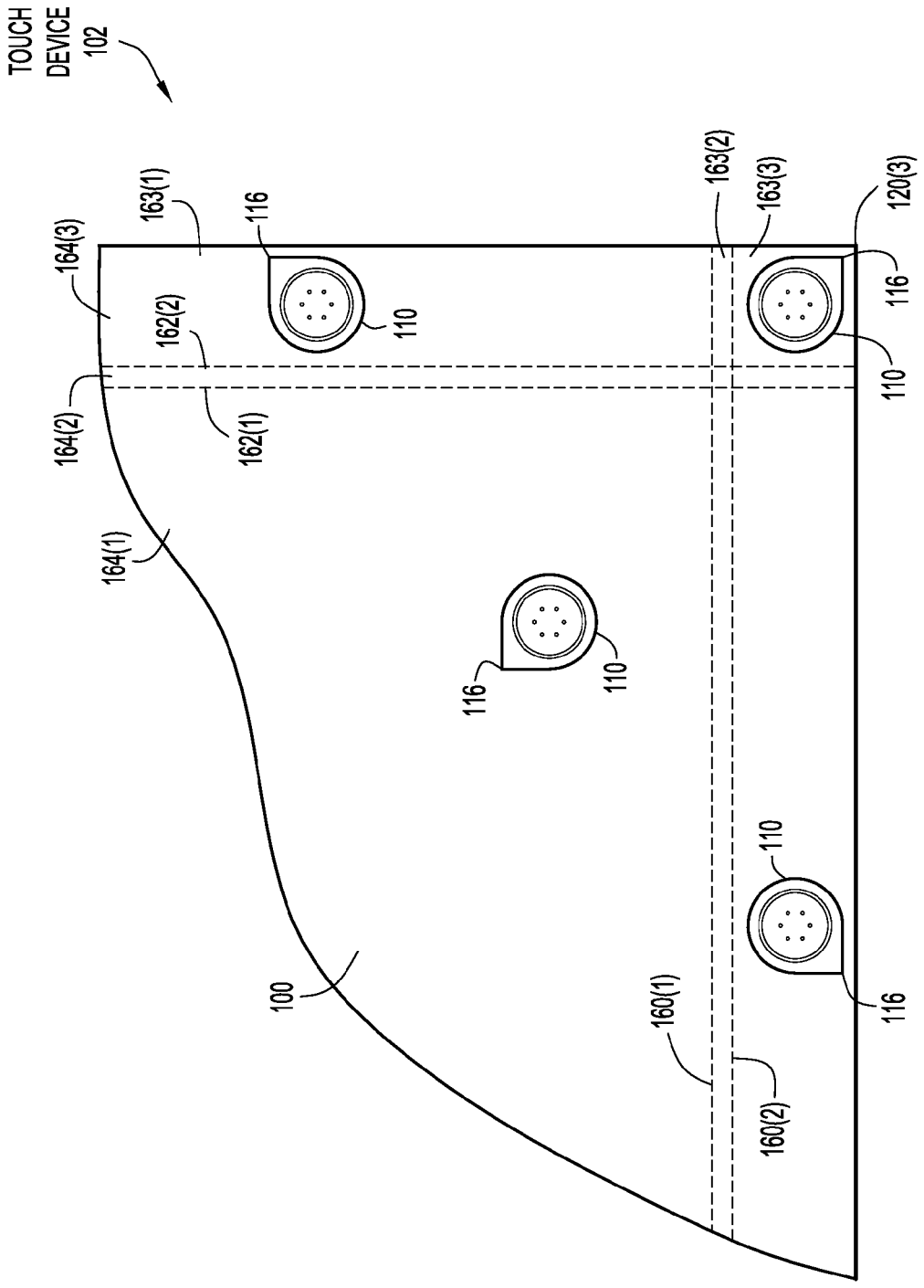
116
110
152(3)
104(8)
104(9)
132(2)
REGION 150(3)
157
104(4)
116
110
152(2)
159
132(1)
REGION 150(2)
110
116
152(1)
104(10)
REGION 150(1)
120(1)
104(3)
104(2)
104(1)
120(4)

FIG.4B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163(1)
116
163(2)
163(3)
120(3)
164(3)
110
116
162(2)
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164(2)
162(1)
164(1)
116
110
110
116
100
160(1)
160(2)

FIG.5

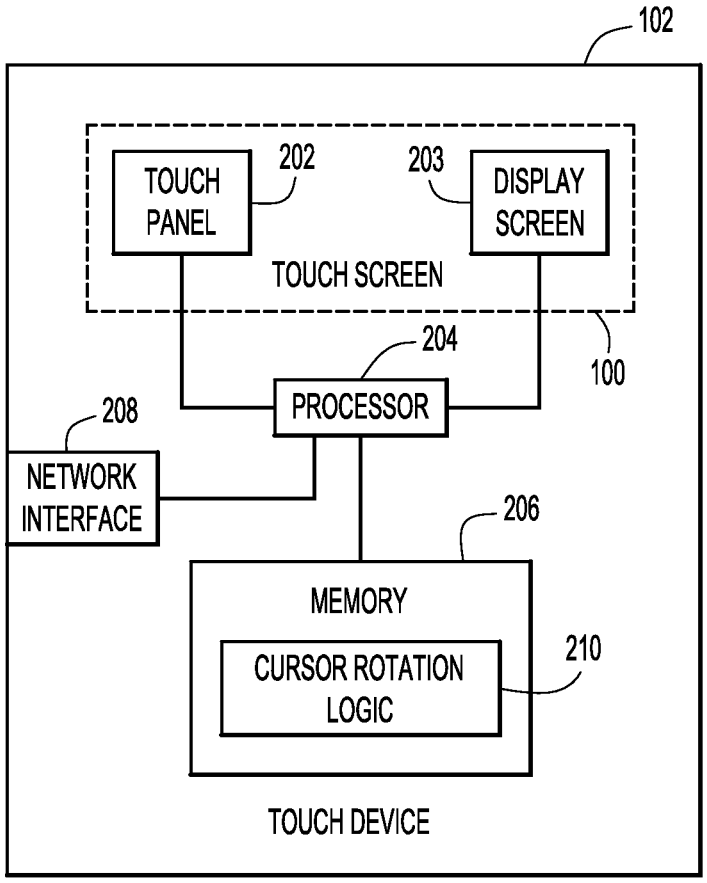
102
TOUCH PANEL
202
203
DISPLAY SCREEN
TOUCH SCREEN
100
204
PROCESSOR
208
NETWORK INTERFACE
206
MEMORY
CURSOR ROTATION LOGIC
210
TOUCH DEVICE

FIG.6

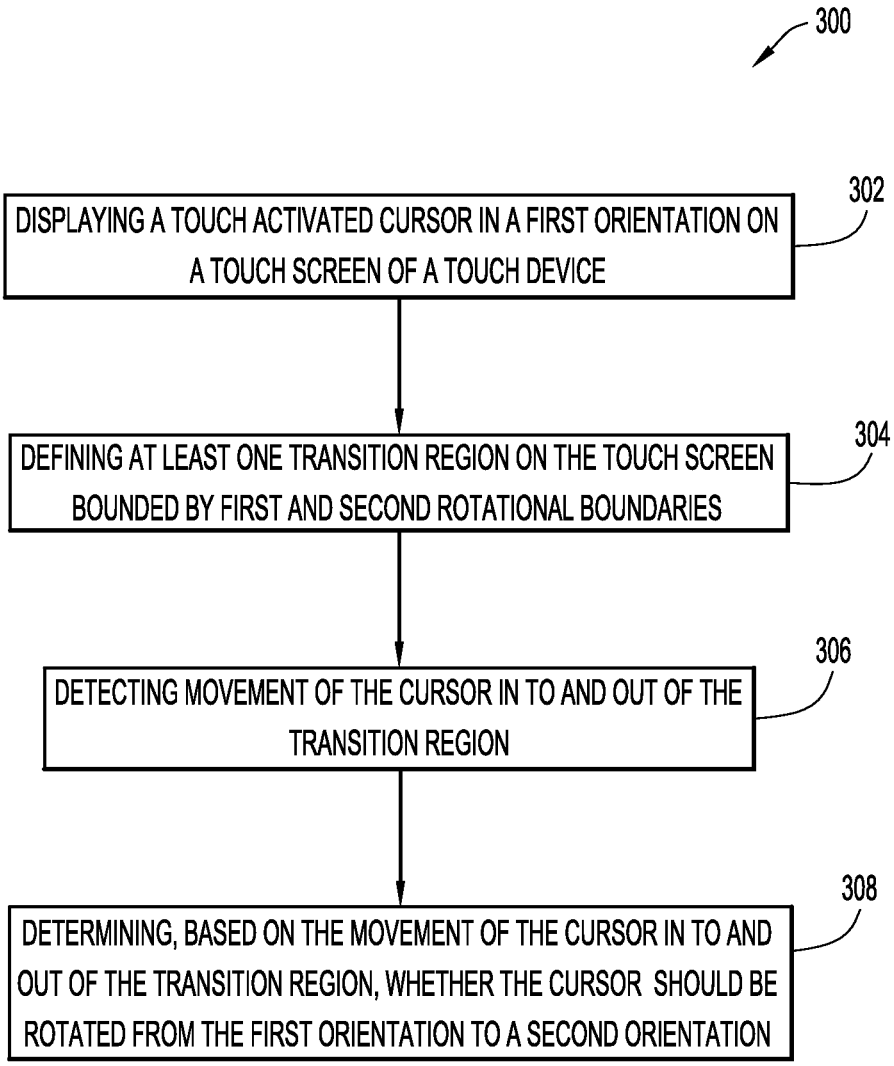
300
DISPLAYING A TOUCH ACTIVATED CURSOR IN A FIRST ORIENTATION ON A TOUCH SCREEN OF A TOUCH DEVICE
302
DEFINING AT LEAST ONE TRANSITION REGION ON THE TOUCH SCREEN BOUNDED BY FIRST AND SECOND ROTATIONAL BOUNDARIES
304
DETECTING MOVEMENT OF THE CURSOR IN TO AND OUT OF THE TRANSITION REGION
306
DETERMINING, BASED ON THE MOVEMENT OF THE CURSOR IN TO AND OUT OF THE TRANSITION REGION, WHETHER THE CURSOR SHOULD BE ROTATED FROM THE FIRST ORIENTATION TO A SECOND ORIENTATION
308

FIG.7

AUTOMATIC CURSOR ROTATION

RELATED APPLICATION DATA

This application claims priority under 35 U.S.C 119 to Taiwan patent application, TW 102106419, filed on Feb. 23, 2013, the disclosure of which is incorporated herein by reference.

TECHNICAL FIELD

Background

Touch sensors or touch panels have become a popular type of user interface and are used in many types of electronic devices, such as mobile phones, personal digital assistants (PDAs), navigation devices, video games, computers (e.g., tablets), etc., collectively referred to herein as touch devices. Touch devices recognize a touch input of a user and obtain the location of the touch to effect a selected operation.

A touch panel may be positioned in front of a display screen such as a liquid crystal display (LCD), or may be integrated with a display screen. Such configurations, referred to as touch screens, allow the user to intuitively connect a pressure point of the touch panel with a corresponding point on the display screen, thereby creating an active connection with the screen. In general, a finger or stylus is used to interact with the touch screen to, for example, select various displayed objects (e.g., icons, menus, etc.). In certain cases, a displayed object may be small, thereby making it difficult for users to quickly or accurately select the displayed object.

SUMMARY

In accordance with certain embodiments presented herein, a touch device is configured to display a touch activated cursor that enhances a user's ability to select objects on the touch screen. The touch device is configured to automatically rotate the cursor depending on movement of the cursor on the touch screen. More specifically, the touch device defines at least one transition region on the touch screen bounded by first and second rotational boundaries. The touch device is configured to detect movement of the cursor in to and out of the transition region. The touch device is also configured to determine, based on the movement of the cursor in to and out of the transition region, whether the cursor should be rotated from a first orientation to a second orientation.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments are described herein in conjunction with the accompanying drawings, in which:

FIG. **1** is a schematic diagram of a touch device configured to display a touch activated cursor;

FIGS. **2**A and **2**B are schematic diagrams of a touch device during display of a touch activated cursor;

FIGS. **3**A and **3**B are schematic diagrams of a touch device configured to implement automatic cursor rotation techniques in accordance with embodiments presented herein;

FIGS. **4**A and **4**B are schematic diagrams of a touch device configured to implement automatic cursor rotation techniques in accordance with embodiments presented herein;

FIG. **5** is a schematic diagram of a touch device configured to implement automatic cursor rotation techniques in accordance with embodiments presented herein;

FIG. **6** is a block diagram of a touch device configured to implement automatic cursor techniques in accordance with embodiments presented herein; and

FIG. **7** is a flowchart of a method in accordance with embodiments presented herein.

DESCRIPTION OF EXAMPLE EMBODIMENTS

FIG. **1** is a schematic diagram of a touch screen **100** of a touch device **102** configured to display a touch activated cursor. The touch device **102** may be, for example, a tablet computing device, mobile phone, personal digital assistant (PDA), desktop computer, navigation device, laptop computer, or any other device that includes a touch screen.

Touch screen **100** comprises a touch sensor/panel that is positioned on front of, or integrated with, a display screen. Touch screen **100** is configured to recognize touch inputs of a user and determine the location of the touch input. The touch screen **100** connects a pressure point of the touch panel with a corresponding point on the display screen, thereby providing the user with an intuitive connection with the screen. The touch input may be, for example, physical contact via a finger, a stylus, etc. It is to be appreciated that the touch device **102** may also include other types of user interfaces, such as, for example, a keyboard, a mouse, a trackpad, etc. These alternative user interfaces have, for ease of illustration, been omitted from FIG. **1**.

As shown, the touch screen **100** has corners **120**(**1**), **120**(**2**), **120**(**3**), and **120**(**4**). A first edge **122**(**1**) of the touch screen **100** extends between the first corner **120**(**1**) and the second corner **120**(**2**), while a second edge **122**(**2**) of the touch screen **100** extends between the second corner **120**(**2**) and the third corner **120**(**3**). A third edge **122**(**3**) of the touch screen **100** extends between the third corner **120**(**3**) and the fourth corner **120**(**4**), while a fourth edge **122**(**4**) of the touch screen **100** extends between the fourth corner **120**(**4**) and the first corner **120**(**1**). The touch screen **100** may have a generally square shape where all edges **122**(**1**)-**122**(**4**) are the same length or a generally rectangular shape where two parallel edges (e.g., edges **122**(**1**) and **122**(**3**) or edges **122**(**2**) and **122**(**4**)) are longer than the other two edges.

The touch screen **100** is configured to display a plurality of user interface (UI) elements or objects **104**(**1**)-**104**(**10**). The displayed objects **104**(**1**)-**104**(**10**) may comprise, for example, icons, menus, tools/toolbars, panels, documents, etc. In certain embodiments, the displayed objects **104**(**1**)-**104**(**10**) may be small in size, thereby making it difficult for users to quickly or accurately select the displayed objects. As such, the touch device **102** is configured to display a touch activated cursor (touch cursor) **110** on the touch screen **100** that enhances a user's ability to select displayed objects. The cursor **110** may be initially displayed on the touch screen **100** by, for example, accessing a tool menu.

The cursor **110** comprises a touch sensitive area **112** and a pointer **114**. The pointer **114** terminates in a fine tip (point) **116**. Using the cursor **110**, a user can select, drag or tap on small objects **104**(**1**)-**104**(**10**) that may be difficult to select with a fingertip. More specifically, a user can place a fingertip on the touch sensitive area **112** and drag the cursor **110** to different points on the touch screen **100**. In general, the cursor **110** can be dragged in any direction until the touch sensitive area **112** reaches an edge of the touch screen **100**. Since it is the user's touch at the touch sensitive area **112** that controls the movement of the cursor **110**, once the touch sensitive area **112** reaches an edge of the touch screen **100**, the cursor can not be moved any further in that direction (i.e., the touch

sensitive area **112** cannot be moved and/or controlled outside of the area of the touch screen **100**).

Through touches at the touch sensitive area **112**, the cursor **100** also enables a user to perform all standard touch screen commands including tap, double-tap, drag, and drag-select, etc. For example, to select an item on the screen, such as displayed object **104**(**2**), the touch sensitive area **112** is used to position the tip **116** of pointer **114** over the object **104**(**2**). The user may then tap or double-tap the touch sensitive area **112**, causing the object **104**(**2**) (i.e., the item positioned underneath the tip **116**) to be selected.

Additionally, to drag an item, such as displayed object **104**(**2**), across the touch screen **100**, the touch sensitive area **112** is used to position tip **116** of pointer **114** over the displayed object **104**(**2**). The user may then press briefly on the touch sensitive area **112** to activate a drag mode during which the displayed object **104**(**2**) can be dragged to a new location. When the displayed object **104**(**2**) is at a new position, the user may then again briefly press the touch sensitive area **112** to deactivate the drag mode and release control over the displayed object **104**(**2**) (i.e., cause the displayed object to remain at the new location).

As noted above, the cursor **110** enables a user to perform all standard touch screen commands (e.g., activation of menus/displays, text editing, etc.) through one or more touches at the touch sensitive area **112**. In general, since the tip **116** of pointer **114** has a size/shape that is smaller than a typical user's fingertip, the pointer **116** enables greater granularity and selectability in comparison to a fingertip touch. That is, the cursor **110** provides a user with precise pointing control on the touch screen **100** in situations where it may be difficult to do so using only a fingertip. The fine tip **116** allows a user to work with even very small screen elements which may be particularly helpful when using operating system setting and configuration windows with small buttons, boxes or other small items.

As shown in FIG. **1**, the cursor **110** may have a default orientation where the tip **116** of pointer **114** points towards the first corner **120**(**1**) of the touch screen. In this orientation, the user has the ability to select displayed objects positioned along edges **122**(**4**) (i.e., objects **104**(**1**)-**104**(**3**)) and **122**(**1**) (i.e., object **104**(**4**)). That is, a user can move the cursor **110** so as to position the tip **116** over those displayed objects **104**(**1**)-**104**(**4**). However, the user cannot select displayed objects positioned along edges **122**(**2**) (i.e., objects **104**(**5**), **104**(**6**), and **104**(**7**)) and **122**(**3**) (i.e., objects **104**(**8**), **104**(**9**), and **104**(**10**)).

More specifically, as shown in FIG. **2**A, when the cursor **110** is moved as close as possible to edge **122**(**2**) (i.e., such that the cursor **110** abuts the edge **122**(**2**)), the tip **116** is positioned outside of an edge zone **126** in which the objects **104**(**5**)-**104**(**7**) are positioned. That is, the size and orientation of cursor **110** prevents the tip **116** from being positioned sufficiently close to edge **122**(**2**) to select objects **104**(**5**)-**104**(**7**) (or any other items in edge zone **126**). Similarly, as shown in FIG. **2**B, when the cursor **110** is moved as close as possible to edge **122**(**3**) (i.e., such that the cursor **110** abuts the edge **122**(**3**)), the tip **116** is positioned outside of an edge zone **128** in which the objects **104**(**8**)-**104**(**10**) are positioned. That is, the size and orientation of cursor **110** prevents the tip **116** from being positioned sufficiently close to edge **122**(**3**) to select objects **104**(**8**)-**104**(**10**) (or any other items in edge zone **128**). Accordingly, in the arrangements of FIGS. **2**A and **2**B, the objects along edges **122**(**2**) and **122**(**3**) are only selectable when the cursor **110** is not used (i.e., via a direct fingertip touch).

Presented herein are techniques that enable a touch device to automatically rotate a displayed touch activated cursor, where the automatic rotation depends on the movement of the cursor. More specifically, the techniques presented herein create one or more transition regions on the touch screen that are bounded by rotational boundaries. The touch device is configured to automatically rotate the cursor depending on the direction of movement of the cursor into and out of the transition region. For ease of illustration, the automatic cursor rotation techniques will be described with reference to the touch device **102** having the touch screen **100** as described above.

FIGS. **3**A and **3**B are schematic diagrams illustrating touch screen **100** during a first automatic cursor rotation technique in accordance with embodiments presented. As shown, the touch screen **100** includes two longitudinal rotational boundaries **130**(**1**) and **130**(**2**) that functionally divide the touch screen **100** into three longitudinal regions, namely a first longitudinal region **140**(**1**), a second longitudinal region **140**(**2**), and a third longitudinal region **140**(**3**). As described further below, the second longitudinal region **140**(**2**), which is bounded by the rotational boundaries **130**(**1**) and **130**(**2**), forms a transition region. In practice, the longitudinal rotational boundaries **130**(**1**) and **130**(**2**) are defined to correspond to locations on the screen, but generally are not visible on touch screen **100**. As such, longitudinal rotational boundaries **130**(**1**) and **130**(**2**) are shown in FIGS. **3**A and **3**B merely for purposes of illustration.

Referring specifically to FIG. **3**A, three instances of cursor **100** are shown at different positions on the touch screen **100**. More particularly, cursor **100** is shown at a first position **142**(**1**) within region **140**(**1**), at a second position **142**(**2**) within transition region **140**(**2**), and at a third position **142**(**3**) within region **140**(**3**). It is to be appreciated that the three instances of cursor **100** are shown merely for purposes of illustration and collectively reflect movement of cursor **100** in direction of arrow **144** (i.e., from region **140**(**1**) to **140**(**3**)) over a period of time. In operation, only one instance of the cursor **110** would appear on touch screen **100** at any given time.

The cursor **110** is first located at position **142**(**1**) (within region **140**(**1**)) and the cursor has a first orientation where the tip **116** points in the general direction of corner **120**(**1**). The user moves the cursor **110** to position **142**(**2**) such that the cursor **110** crosses the rotational boundary **130**(**1**) and moves into transition region **140**(**2**). The touch device **102** is configured such that when the cursor **110** crosses into transition region **140**(**2**), the orientation of the cursor does not change. In the case of FIG. **3**A, the cursor **110** is maintained in the orientation in which tip **116** points in the general direction of corner **120**(**1**).

The user further moves the cursor **110** from the second position **142**(**2**) (within transition region **140**(**2**)) to position **142**(**3**) (within region **140**(**3**)). During this movement, the cursor **110** crosses the rotational boundary **130**(**2**). When the cursor **110** exits the transition region **140**(**2**), the touch device **102** is configured to determine whether the cursor should be rotated to a new orientation. The determination of whether the cursor **110** should be rotated depends on the movement of the cursor **110** out of the transition region (i.e., which rotational boundary is crossed as the cursor **110** exits the transition region **140**(**2**)).

More specifically, when the cursor **110** crosses a rotational boundary upon exit from the transition region **140**(**2**) that is different from the rotational boundary that was crossed when the cursor **110** entered the transition region, the touch device **100** is configured to automatically rotate the cursor **110** to a

different orientation. In the embodiment of FIG. **3**A, the cursor **110** exits the transition region **140**(**2**) by crossing the rotational boundary **130**(**2**), which is different from the rotational boundary **130**(**1**) that was crossed as the cursor **110** entered the transition region **140**(**2**). As such, the touch device **102** is configured to rotate the cursor **110** such that the tip **116** of the cursor **110** points in the general direction of corner **120**(**4**). The rotation of cursor **110** is illustrated in FIG. **3**A by arrow **146**.

FIG. **3**B illustrates movement of cursor **110** that is opposite from that shown in FIG. **3**A, namely movement from position **142**(**3**) to position **142**(**1**). This movement is generally represented in FIG. **3**B by arrow **147**. At position **142**(**3**), the tip **116** of cursor **110** points in the general direction of corner **120**(**4**).

In FIG. **3**B, the user moves the cursor **110** to position **142**(**2**) within transition region **140**(**2**) so that the cursor **110** crosses the rotational boundary **130**(**2**). As noted above, the touch device **102** is configured such that when the cursor **110** crosses a first rotational boundary during entry into the transition region **140**(**2**), the orientation of the cursor does not change. As such, during the movement from position **142**(**3**) to position **142**(**2**), the touch device **102** does not rotate the cursor **110** to change the direction of tip **116**.

As shown in FIG. **3**B, the user further moves the cursor **110** from the second position **142**(**2**) (within transition region **140**(**2**)) to position **142**(**1**) (within region **140**(**1**)). During this movement, the cursor **110** crosses the rotational boundary **130**(**1**). As noted above, the touch device **102** is configured such that when the cursor **110** crosses a rotational boundary upon exiting the transition region **140**(**2**), the touch device **102** determines whether the cursor should be rotated to a new orientation. The determination of whether the cursor **110** should be rotated depends on the movement of the cursor **110** out of the transition region (i.e., which rotational boundary is crossed as the cursor **110** exits the transition region **140**(**2**)). In the embodiment of FIG. **3**B, the cursor **110** exits the transition region **140**(**2**) by crossing the rotational boundary **130**(**1**), which is different from the rotational boundary **130**(**2**) that was crossed as the cursor **110** entered the transition region **140**(**2**). As such, the touch device **102** is configured to rotate the cursor **110** such that the tip **116** of the cursor **110** points in the general direction of corner **120**(**1**). The rotation of cursor **110** is illustrated in FIG. **3**B by arrow **149**.

In summary, FIGS. **3**A and **3**B illustrate two longitudinal rotational boundaries that define a longitudinal transition region that is used to control the orientation of a displayed touch cursor **110**. As noted, the touch device **102** may automatically rotate the orientation of cursor **110** as the cursor exits the transition region. The determination of whether the cursor should be rotated depends on the direction of movement of the cursor relative to the rotational boundaries that are crossed as the cursor entered and exited the transition region.

FIGS. **4**A and **4**B are schematic diagrams illustrating touch screen **100** during a second automatic cursor rotation technique in accordance with embodiments presented. As shown, the touch screen **100** includes two transverse rotational boundaries **132**(**1**) and **132**(**2**) that functionally divide the touch screen **100** into three transverse regions, namely a first transverse region **150**(**1**), a second transverse region **150**(**2**), and a third transverse region **150**(**3**). As described further below, the second transverse region **150**(**2**), which is bounded by the rotational boundaries **132**(**1**) and **132**(**2**), forms a transition region. In practice, the longitudinal rotational boundaries **132**(**1**) and **132**(**2**) are defined to correspond to locations on the screen, but generally are not visible on touch screen **100**. As such, transverse rotational boundaries **132**(**1**) and **132**(**2**) are shown in FIGS. **4**A and **4**B merely for purposes of illustration.

Referring specifically to FIG. **4**A, three instances of cursor **100** are shown at different positions on the touch screen **100**. More particularly, cursor **100** is shown at a first position **152**(**1**) within region **150**(**1**), at a second position **152**(**2**) within transition region **150**(**2**), and at a third position **152**(**3**) within region **150**(**3**). It is to be appreciated that the three instances of cursor **100** are shown merely for purposes of illustration and collectively reflect movement of cursor **100** in direction of arrow **154** (i.e., from position **150**(**1**) to **150**(**3**)) over a period of time. In operation, only one instance of the cursor **110** would appear on touch screen **100** at any given time.

The cursor **110** is first located at position **152**(**1**) (within region **150**(**1**)) and the cursor has a first orientation where the tip **116** points in the general direction of corner **120**(**1**). The user moves the cursor **110** to position **152**(**2**) such that the cursor **110** crosses the rotational boundary **132**(**1**) and moves into transition region **150**(**2**). The touch device **102** is configured such that when the cursor **110** crosses into transition region **150**(**2**), the orientation of the cursor does not change. In the case of FIG. **4**A, the cursor **110** is maintained in the orientation in which tip **116** points in the general direction of corner **120**(**1**).

The user further moves the cursor **110** from the second position **152**(**2**) (within transition region **150**(**2**)) to position **152**(**3**) (within region **150**(**3**)). During this movement, the cursor **110** crosses the rotational boundary **132**(**2**). When the cursor **110** exits the transition region **150**(**2**), the touch device **102** is configured to determine whether the cursor should be rotated to a new orientation. The determination of whether the cursor **110** should be rotated depends on the movement of the cursor **110** out of the transition region (i.e., which rotational boundary is crossed as the cursor **110** exits the transition region **150**(**2**)).

More specifically, when the cursor **110** crosses a rotational boundary upon exit from the transition region **150**(**2**) that is different from the rotational boundary that was crossed when the cursor **110** entered the transition region, the touch device **100** is configured to automatically rotate the cursor **110** to a different orientation. In the embodiment of FIG. **4**A, the cursor **110** exits the transition region **150**(**2**) by crossing the rotational boundary **132**(**2**), which is different from the rotational boundary **132**(**1**) that was crossed as the cursor **110** entered the transition region **150**(**2**). As such, the touch device **102** is configured to rotate the cursor **110** such that the tip **116** of the cursor **110** points in the general direction of corner **120**(**2**). The rotation of cursor **110** is illustrated in FIG. **4**A by arrow **156**.

FIG. **4**B illustrates movement of cursor **110** that is opposite from that shown in FIG. **4**A, namely from position **152**(**3**) to position **152**(**1**). This movement is generally represented in FIG. **4**B by arrow **157**. At position **152**(**3**), the tip **116** of cursor **110** points in the general direction of corner **120**(**2**).

In FIG. **4**B, the user moves the cursor **110** to position **152**(**2**) within transition region **150**(**2**) so that the cursor **110** crosses the rotational boundary **132**(**2**). As noted above, the touch device **102** is configured such that when the cursor **110** crosses a first rotational boundary during entry into the transition region **150**(**2**), the orientation of the cursor does not change. As such, during the movement from position **152**(**3**) to position **152**(**2**), the touch device **102** does not rotate the cursor **110** to change the direction of tip **116**.

As shown in FIG. **4**B, the user further moves the cursor **110** from the second position **152**(**2**) (within transition region

150(2)) to position 152(1) (within region 150(1)). During this movement, the cursor 110 crosses the rotational boundary 132(1). As noted above, the touch device 102 is configured such that when the cursor 110 crosses a rotational boundary upon exiting the transition region 150(2), the touch device 102 determines whether the cursor should be rotated to a new orientation. The determination of whether the cursor 110 should be rotated depends on the movement of the cursor 110 out of the transition region (i.e., which rotational boundary is crossed as the cursor 110 exits the transition region 150(2)). In the embodiment of FIG. 4B, the cursor 110 exits the transition region 150(2) by crossing the rotational boundary 132(1), which is different from the rotational boundary 132(2) that was crossed as the cursor 110 entered the transition region 150(2). As such, the touch device 102 is configured to rotate the cursor 110 such that the tip 116 of the cursor 110 points in the general direction of corner 120(1). The rotation of cursor 110 is illustrated in FIG. 4B by arrow 159.

In summary, FIGS. 4A and 4B illustrate two transverse rotational boundaries that define a transverse transition region that is used to control the orientation of a displayed touch cursor 110. As noted, the touch device 102 may automatically rotate the orientation of cursor 110 as the cursor exits the transition region. The determination of whether the cursor should be rotated depends on the direction of movement of the cursor relative to the rotational boundaries that are crossed as the cursor entered and exited the transition region.

FIG. 5 illustrates a portion of touch screen 100 that is near corner 120(3) in an embodiment that includes two longitudinal rotational boundaries 160(1) and 160(2) and two transverse boundaries 162(1) and 162(2) (i.e., four rotational boundaries). The longitudinal rotational boundaries 160(1) and 160(2) functionally divide the touch screen 100 in three longitudinal regions 163(1), 163(2), and 163(3). The transverse rotational boundaries 162(1) and 163(2) functionally divide the touch screen 100 in three longitudinal regions 164(1), 164(2), and 164(3).

In the embodiment of FIG. 5, the longitudinal boundaries and transverse boundaries collectively enable the cursor 110 to have any of four different orientations. More specifically, when the cursor 110 is in longitudinal region 163(1) while also in transverse region 164(1), tip 116 of cursor 110 points in the general direction of corner 120(1) (upper left corner, not shown in FIG. 5). When the cursor 110 is in longitudinal region 163(1) while also in transverse region 164(3), the tip 116 of cursor 110 points in the general direction of corner 120(2) (upper right corner, not shown in FIG. 5). When the cursor 110 is in longitudinal region 163(3) while also in transverse region 164(1), tip 116 of cursor 110 points in the general direction of corner 120(4) (lower left corner, not shown in FIG. 5). When the cursor 110 is in longitudinal region 163(3) while also in transverse region 164(3), tip 116 of cursor 110 points in the general direction of corner 120(3).

In FIG. 5, the regions 163(2) and 164(2) operate as transition regions in which the orientation of cursor 110 does not change. More specifically, the orientation of cursor 110 does not change as it crosses a first rotational boundary to enter a transition region 163(2) or 164(2). However, the orientation of cursor 110 does change if the cursor 110 is moved out of the transition region 163(2) or 164(2) across the second corresponding rotational boundary. For example, if cursor 110 is moved from region 164(1) into region 164(2), the cursor 110 crosses transverse rotational boundary 162(1) as it enters region 164(2) and the touch device 102 does not change the orientation of the cursor. If cursor 110 is moved out of region 164(2) back into region 164(1) (i.e., re-crosses transverse rotational boundary 162(1)), the touch device 102 again does not change the orientation of the cursor 110. However, if cursor 110 is moved out of region 164(2) into region 164(3) (i.e., crosses transverse rotational boundary 162(2)), the touch device 102 changes the orientation of the cursor 110 so that the tip 116 generally points in the direction of corner 120(2). This operation continues for opposite movement within transition region 164(2) (i.e., movement from region 164(3) to region 164(1)) and movement in/out of transition region 163(2).

In summary, FIG. 5 illustrates the use of two transverse rotational boundaries and two longitudinal boundaries that define transverse and longitudinal transition regions, respectively, that are used to control the orientation of cursor 110. The touch device 102 may automatically rotate the orientation of cursor 110 as the cursor exits a transition region. The determination of whether the cursor should be rotated depends on the direction of movement of the cursor relative to the rotational boundaries that where crossed as the cursor entered and exited the transition region.

Reference is now made to FIG. 6 that shows a block diagram of the touch device 102. The touch device 102 comprises, among other features, a touch screen 100 that includes a touch sensor (panel) 202 that is positioned on front of, or integrated with, a display screen 203. The touch device 102 also comprises a processor 204, a memory 206, and a network interface 208. The touch panel 202, display screen 203, memory 206, and network interface 208 are coupled to the processor 204.

The display screen 203 is configured to display a touch activated cursor (as described above) and the touch panel 202 is configured to receive one or more touch inputs from the user of the touch device 102 that control the cursor. The touch panel 202 and the display screen 203 may be implemented as an integrated unit.

The processor 204 is a microprocessor or microcontroller that is configured to execute program logic instructions (i.e., software) for carrying out various operations and tasks described herein. For example, the processor 204 is configured to execute cursor rotation logic 210 that is stored in the memory 206 to perform the automatic cursor rotation operations described herein. More specifically, the processor 204 may execute cursor rotation logic 210 to, for example, define rotational boundaries on the display screen 203 and to automatically rotate the displayed cursor depending on the position and movement of the cursor relative to those boundaries. The memory 206 may comprise read only memory (ROM), random access memory (RAM), magnetic disk storage media devices, optical storage media devices, flash memory devices, electrical, optical or other physical/tangible memory storage devices.

It is to be appreciated that the cursor rotation logic 210 may take any of a variety of forms, so as to be encoded in one or more tangible computer readable memory media or storage device for execution, such as fixed logic or programmable logic (e.g., software/computer instructions executed by a processor). The processor 204 may be an application specific integrated circuit (ASIC) that comprises fixed digital logic, or a combination thereof. For example, the processor 204 may be embodied by digital logic gates in a fixed or programmable digital logic integrated circuit, in which digital logic gates are configured to perform the operations of the cursor rotation logic 210.

FIG. 7 is a flowchart of a method 300 in accordance with embodiments presented herein. Method 300 begins at 302 where a touch activated cursor is displayed on a touch screen of a touch device such that cursor has a first orientation. At 304, at least one transition region is defined on the touch

screen, where the transition region is bounded by first and second rotational boundaries. At **306**, movement of the cursor in to and out of the transition region is detected. At **308**, a determination of whether the cursor should be rotated from the first orientation to a second orientation is made based on the movement of the cursor in to and out of the transition region.

In certain embodiments, the method comprises detecting movement of the cursor across the first rotational boundary as the cursor enters the transition region and detecting movement of the cursor across the second rotational boundary as the cursor exits the transition region. In such embodiments, the cursor is automatically rotated from the first orientation to a second orientation, based on the movement of the cursor across the second rotational boundary and out of the transition region.

The above description is intended by way of example only.

What is claimed is:

1. A method, comprising:
- displaying a touch activated cursor in a first orientation on a touch screen of a touch device;
- defining at least one transition region on the touch screen bounded by first and second rotational boundaries;
- detecting movement of the cursor in to and out of the transition region; and
- determining, based on the movement of the cursor in to and out of the transition region, whether the cursor should be rotated from the first orientation to a second orientation.

2. The method of claim **1**, further comprising:
- detecting movement of the cursor across the first rotational boundary as the cursor enters the transition region;
- detecting movement of the cursor across the second rotational boundary as the cursor exits the transition region; and
- automatically rotating the cursor from the first orientation to a second orientation, based on the movement of the cursor across the second rotational boundary as the cursor exits the transition region.

3. The method of claim **1**, further comprising:
- detecting movement of the cursor across the first rotational boundary as the cursor enters the transition region;
- detecting movement of the cursor across the first rotational boundary as the cursor exits the transition region; and
- maintaining the cursor in the first orientation based on the movement of the cursor across the first rotational boundary as the cursor exits the transition region.

4. The method of claim **1**, further comprising:
- maintaining the cursor in the first orientation while in the transition region.

5. The method of claim **1**, wherein defining the at least one transition region on the touch screen comprises:
- defining a longitudinal transition region bounded by a first longitudinal rotational boundary and a second longitudinal rotational boundary.

6. The method of claim **5**, further comprising:
- defining a transverse transition region bounded by a first transverse rotational boundary and a second transverse rotational boundary.

7. The method of claim **1**, wherein defining the at least one transition region on the touch screen comprises:
- defining a transverse transition region bounded by a first transverse rotational boundary and a second transverse rotational boundary.

8. One or more computer readable storage media encoded with software comprising computer executable instructions and when the software is executed operable to:
- display a touch activated cursor in a first orientation on a touch screen of a touch device;
- define at least one transition region on the touch screen bounded by first and second rotational boundaries;
- detect movement of the cursor in to and out of the transition region; and
- determine, based on the movement of the cursor in to and out of the transition region, whether the cursor should be rotated from the first orientation to a second orientation.

9. The computer readable storage media of claim **8**, further comprising instructions operable to:
- detect movement of the cursor across the first rotational boundary as the cursor enters the transition region;
- detect movement of the cursor across the second rotational boundary as the cursor exits the transition region; and
- automatically rotate the cursor from the first orientation to a second orientation, based on the movement of the cursor across the second rotational boundary as the cursor exits the transition region.

10. The computer readable storage media of claim **8**, further comprising instructions operable to:
- detect movement of the cursor across the first rotational boundary as the cursor enters the transition region;
- detect movement of the cursor across the first rotational boundary as the cursor exits the transition region; and
- maintain the cursor in the first orientation based on the movement of the cursor across the first rotational boundary as the cursor exits the transition region.

11. The computer readable storage media of claim **8**, further comprising instructions operable to:
- maintain the cursor in the first orientation while in the transition region.

12. The computer readable storage media of claim **8**, wherein the instructions operable to define the at least one transition region on the touch screen comprise instructions operable to:
- define a longitudinal transition region bounded by a first longitudinal rotational boundary and a second longitudinal rotational boundary.

13. The computer readable storage media of claim **12**, further comprising instructions operable to:
- define a transverse transition region bounded by a first transverse rotational boundary and a second transverse rotational boundary.

14. The computer readable storage media of claim **13**, wherein the instructions operable to define the at least one transition region on the touch screen comprise instructions operable to:
- define a transverse transition region bounded by a first transverse rotational boundary and a second transverse rotational boundary.

15. An apparatus, comprising:
- a memory;
- a touch screen comprising a touch panel and a display screen; and
- a processor configured to:
  - display a touch activated cursor in a first orientation on the display screen,
  - define at least one transition region on display screen bounded by first and second rotational boundaries,
  - detect movement of the cursor in to and out of the transition region in response to touch inputs at the touch panel,
  - determine, based on the movement of the cursor in to and out of the transition region, whether the cursor should be rotated from the first orientation to a second orientation.

16. The apparatus of claim 15, wherein the processor is further configured to:

detect movement of the cursor across the first rotational boundary as the cursor enters the transition region;

detect movement of the cursor across the second rotational boundary as the cursor exits the transition region; and

automatically rotate the cursor from the first orientation to a second orientation, based on the movement of the cursor across the second rotational boundary as the cursor exits the transition region.

17. The apparatus of claim 15, wherein the processor is further configured to:

maintain the cursor in the first orientation while in the transition region.

18. The apparatus of claim 15, wherein to define the at least one transition region on the display screen the processor is configured to:

define a longitudinal transition region bounded by a first longitudinal rotational boundary and a second longitudinal rotational boundary.

19. The apparatus of claim 18, wherein the processor is configured to:

define a transverse transition region bounded by a first transverse rotational boundary and a second transverse rotational boundary.

20. The apparatus of claim 19, wherein to define the at least one transition region on the display screen the processor is configured to:

define a transverse transition region bounded by a first transverse rotational boundary and a second transverse rotational boundary.

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